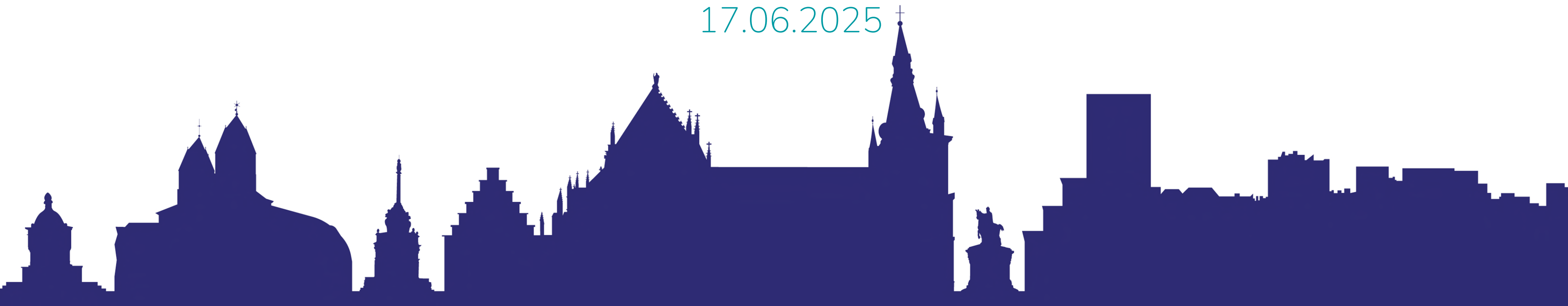


Engineering biology for metaldehyde biodegradation
in drinking water using *Sphingobium spp* and
Acinetobacter calcoaceticus

Yasmin Meeda, *Cranfield University*

17.06.2025





Water is life's matter and matrix,
mother and medium. There is no life
without water.

-Albert Szent-Györgyi



Pesticides in drinking water

0.1 $\mu\text{g/L}$
limits

present in UK
drinking water

toxic to
humans and
wildlife

slug
pesticide



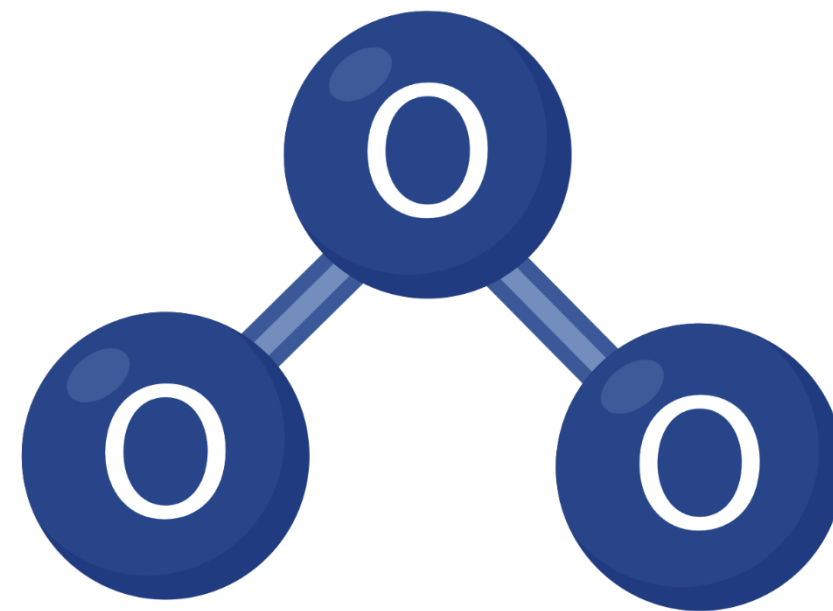
banned in
the UK

Current removal processes

Activated carbon



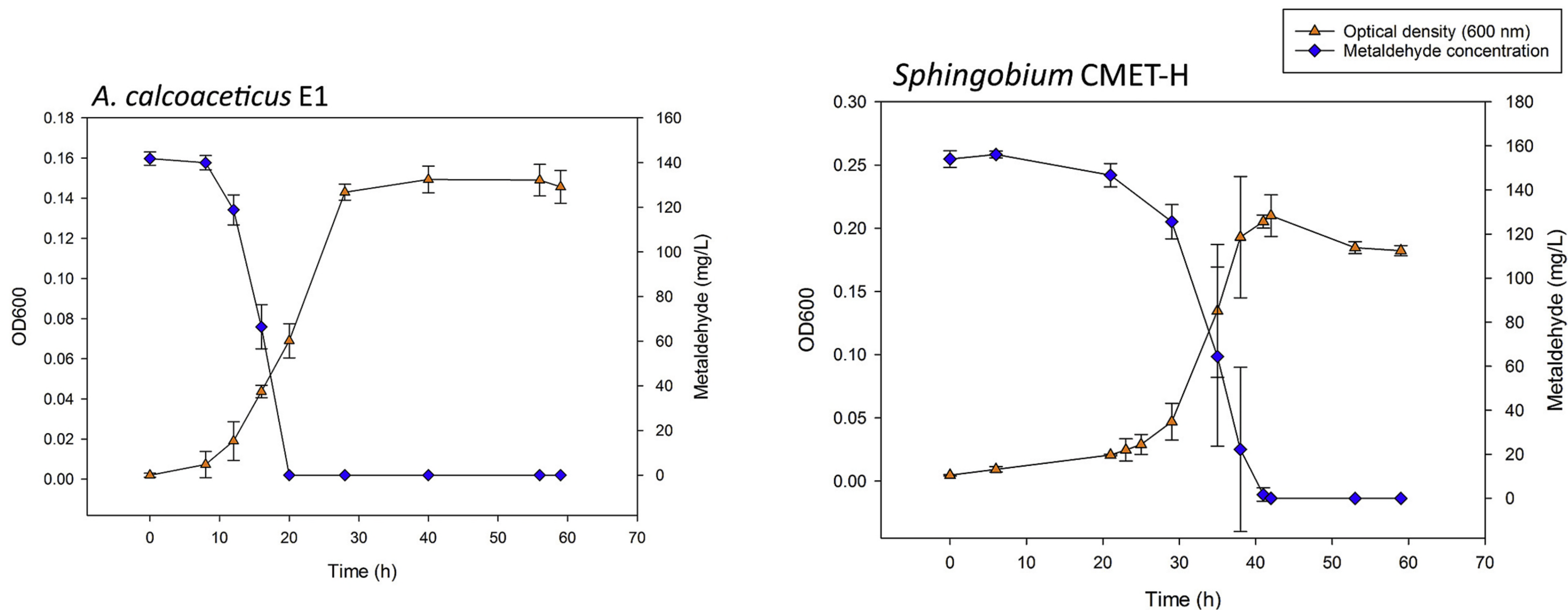
Advanced oxidation



- Energy intensive
- Chemicals
- Costly
- Potential toxic by products

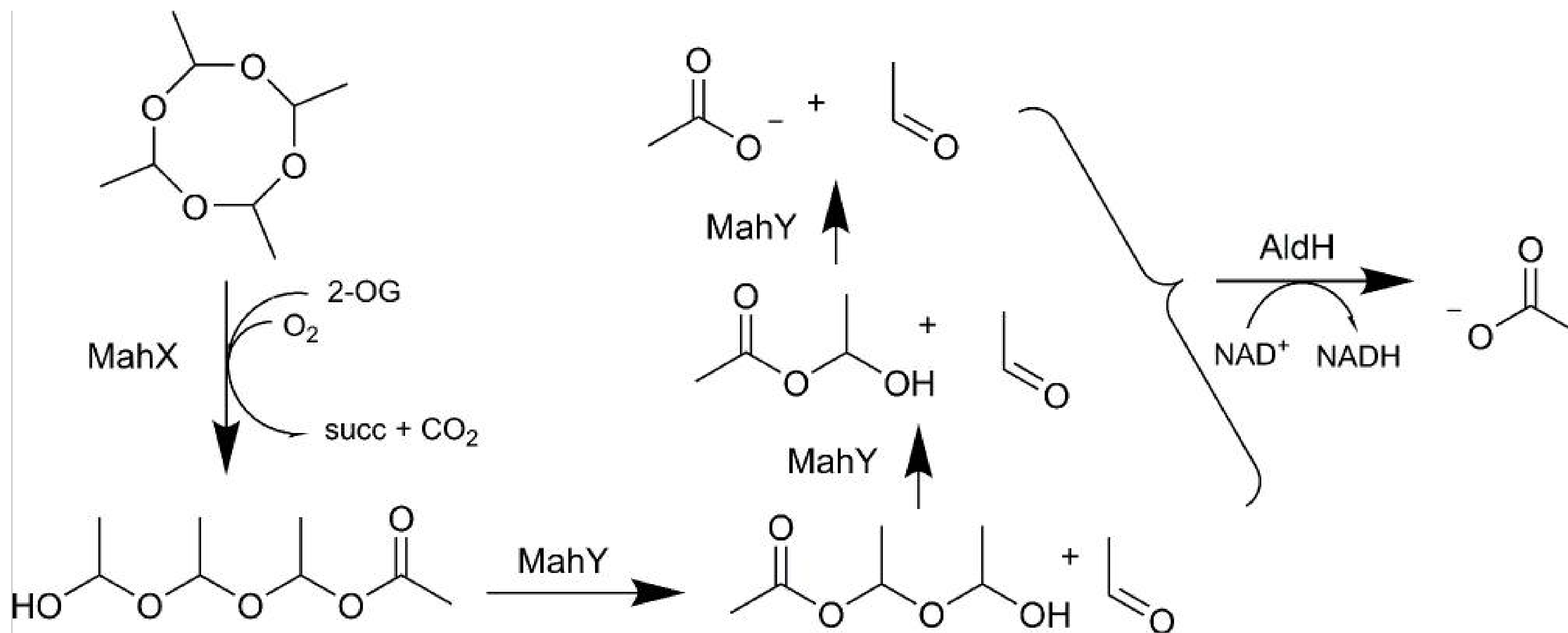


Microbes can naturally biodegrade metaldehyde





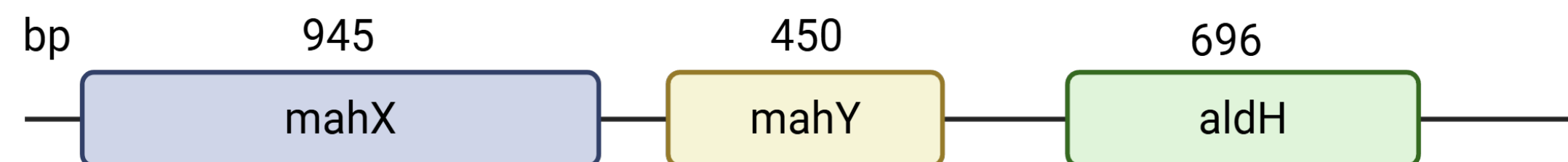
Microbes can naturally biodegrade metaldehyde



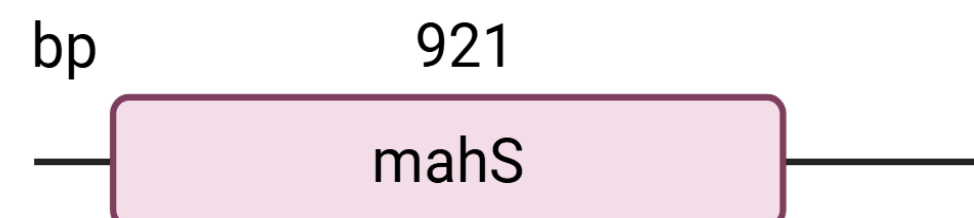


Metaldehyde degrading gene cluster

A. calcoaceticus E1

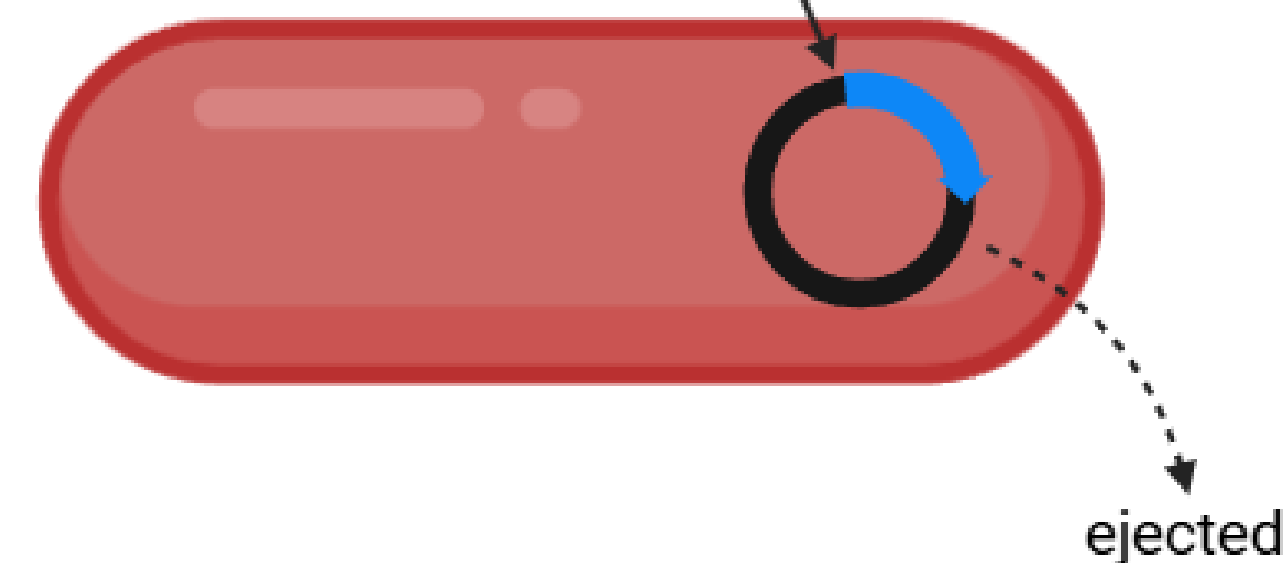


Sphingobium spp. CMET



No metaldehyde in
environment

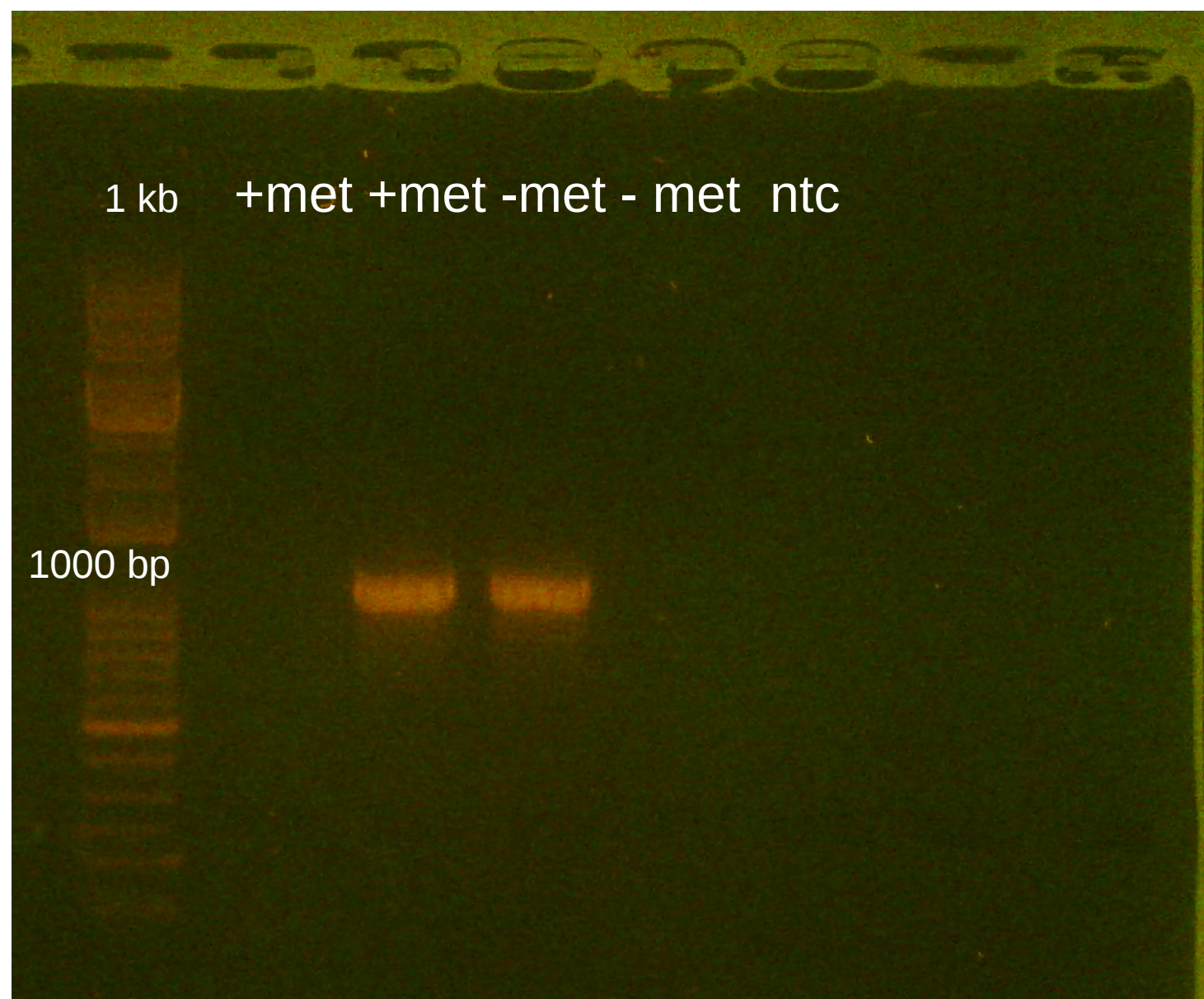
Metaldehyde degrading
gene cluster





Plasmid loss on non-selective media?

Growth on minimal media with metaldehyde as carbon source vs rich media lysogeny both (LB)

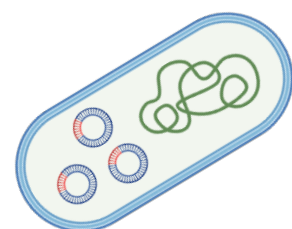


Hypothesis: growth on non-selective media (LB) would lose plasmid

Instead: random or generation time?



Our approach: using synthetic biology



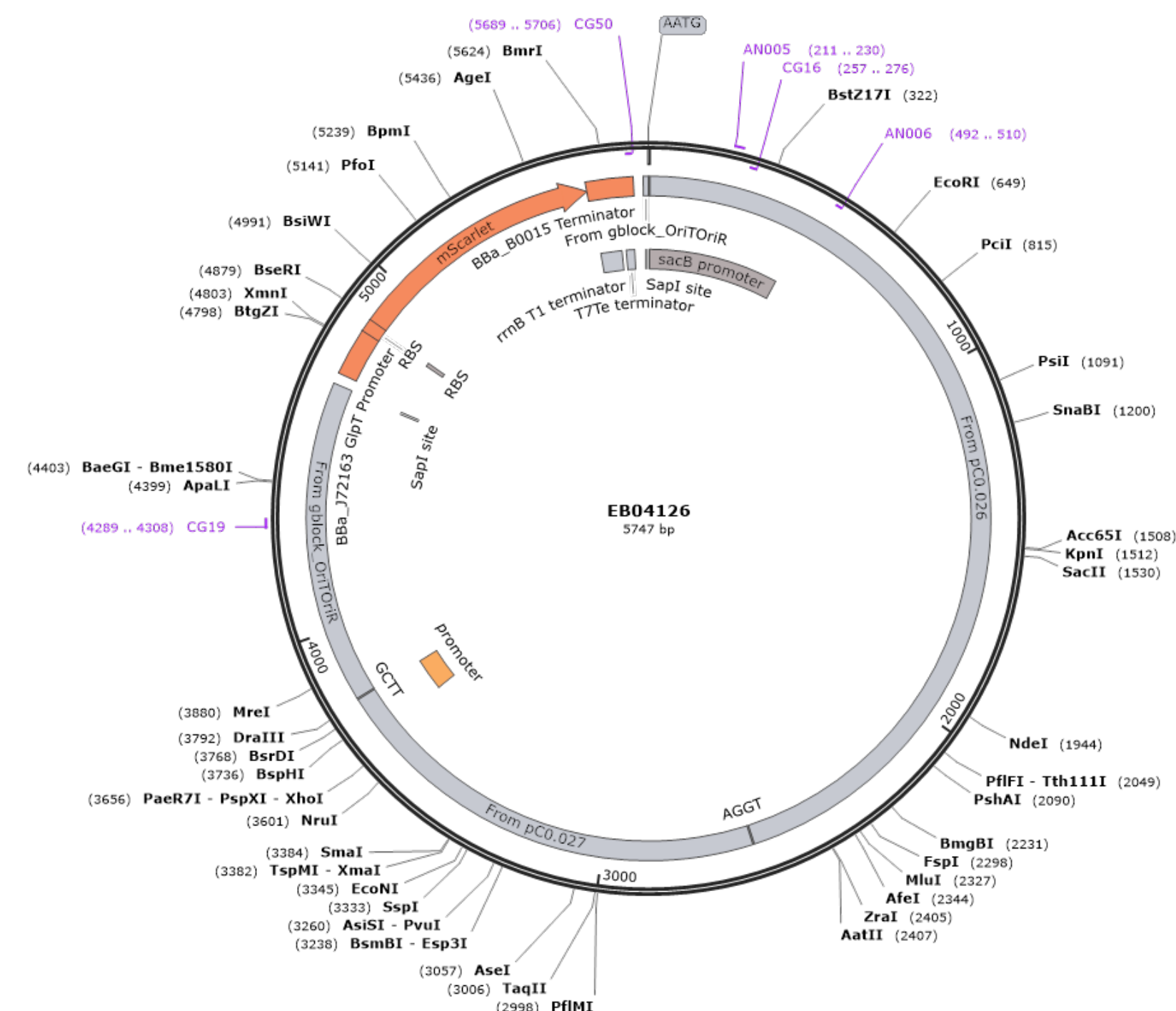
Engineering non-model organisms



Integration of the gene cluster onto the genome (no plasmid loss)

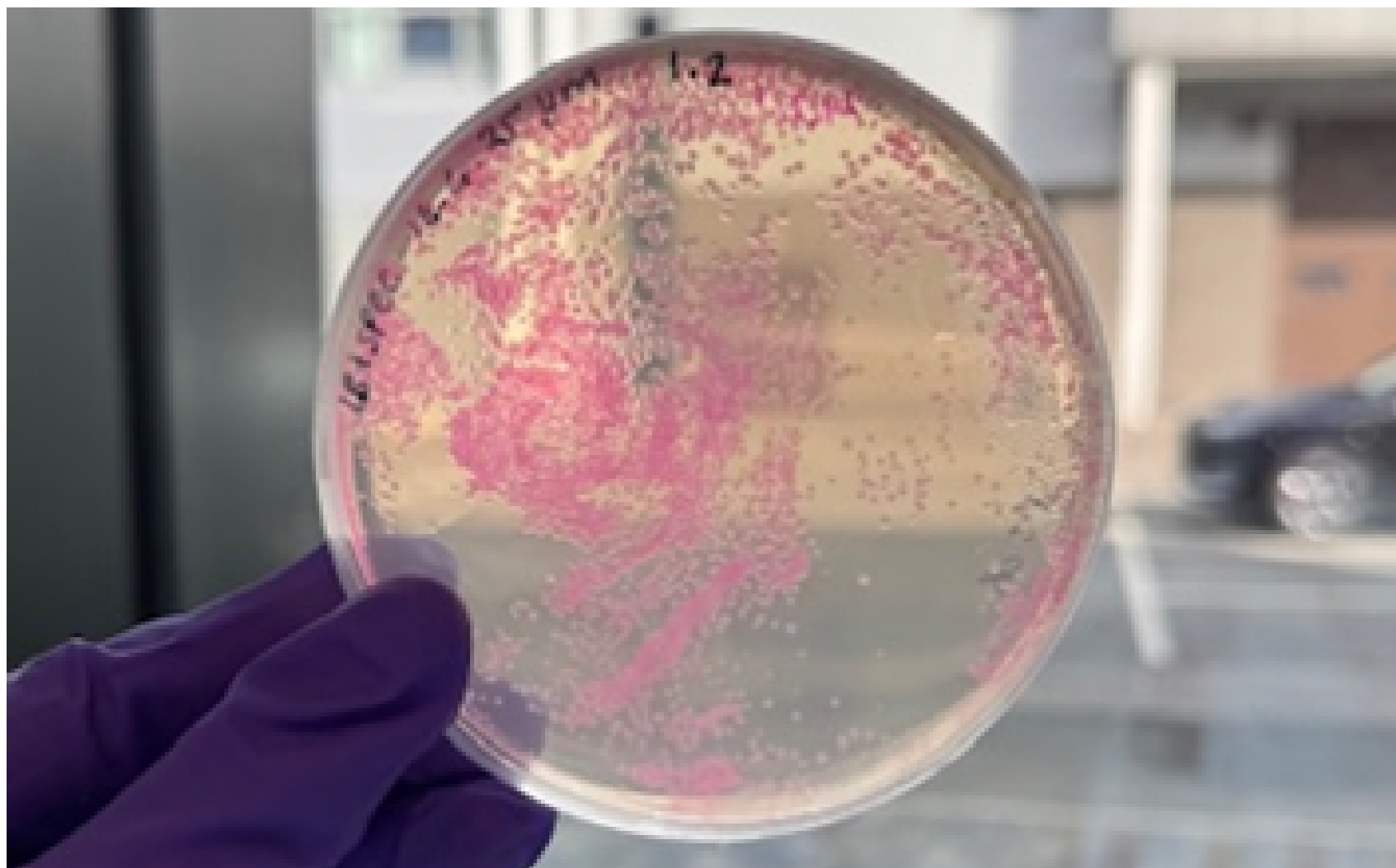


Enhance biodegrading efficiency using constitutively expressed promoter





Transformation protocol – in development



Collaboration with University East Anglia, UK,
Transformation systems that work in non
model organisms

Future work: testing different promoters for
strong metaldehyde gene expression

mScarlet reporter gene in plasmid transformed into E. coli Dh5α



Scale up in drinking water treatment

Lab

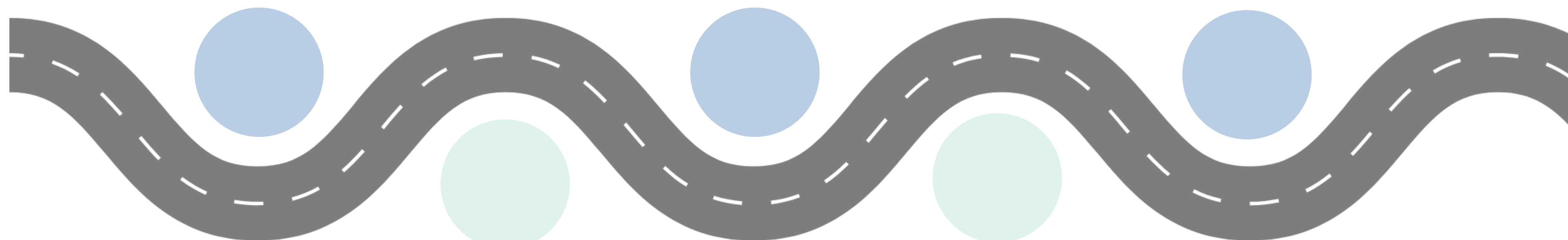
Growth with and without GMO
LCMS metaldehyde removal

Pilot scale

Test in slow sand filters

Field

Work with companies



**Biocontainment
considerations**

Kill switches (on / off)
Genetic barcoding for traceability

Public engagement
“GMO”



Metaldehyde binding to protein (mahX)



Does mahX bind metaldehyde?

Molecular docking ongoing

*Recombinant protein for biosensor development –
detection of metaldehyde in water systems*

A. calcoaceticus metaldehyde gene cluster

Predicted using Phyre



Thank you!

Our partners:



**Biotechnology and
Biological Sciences
Research Council**



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